Lesson I Reading Material: "What is cancer? An Overview."

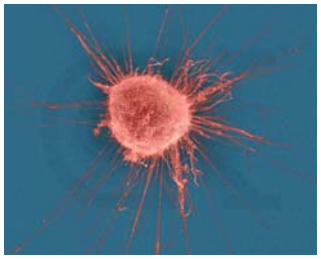
"Tumors destroy man in a unique and appalling way, as flesh of his own flesh which has somehow been rendered proliferative, rampant, predatory, and ungovernable . . . Yet, despite more than 70 years of experimental study, they remain the least understood . . . What can be the why for these happenings?" — Peyton Rous, in his acceptance lecture for the Nobel Prize in Physiology or Medicine (1966)

WHAT IS CANCER?

Cancer develops when cells in a part of the body begin to grow out of control. Although there are many kinds of cancer, they all start because of out-of-control growth of abnormal cells. Normal body cells grow, divide, and die in an orderly fashion. During the early years of a person's life, normal cells divide more rapidly until the person becomes an adult. After that, cells in most parts of the body divide only to replace worn-out or dying cells and to repair injuries. Because cancer cells continue to grow and divide, they are different from normal cells. Instead of dying, they outlive normal cells and continue to form new abnormal cells. Evidence of the existence of cancer can be dated back as far as prehistoric times. It has been found in the skeletons of prehistoric animals and even in Egyptian mummies.

Cancer cells develop because of damage to DNA. This substance is in every cell and directs all activities. Most of the time when DNA becomes damaged the body, normal cells are able to repair it. In cancer cells, the damaged DNA is not repaired. People can inherit damaged DNA, which accounts for inherited cancers. More often, though, a person's DNA becomes damaged by exposure to something in the environment, like smoking.

Cancer cells grow geometrically, meaning first there is one cancer cell, then two, then four, then eight and so on. Cancerous tumors are grouped into one of two categories, malignant or benign. Cancer usually forms as a tumor. Some cancers, like leukemia, do not form tumors. Instead, these cancer cells involve the blood and blood-forming organs and circulate through other tissues where they grow. Not all tumors are cancerous. Benign (noncancerous) tumors do not spread (metastasize) to other parts of the body and, with very rare exceptions, are not life threatening.



The study of cancerous tumors is called oncology. Doctors who specialize in the diagnosis and treatment of cancer are called oncologists.

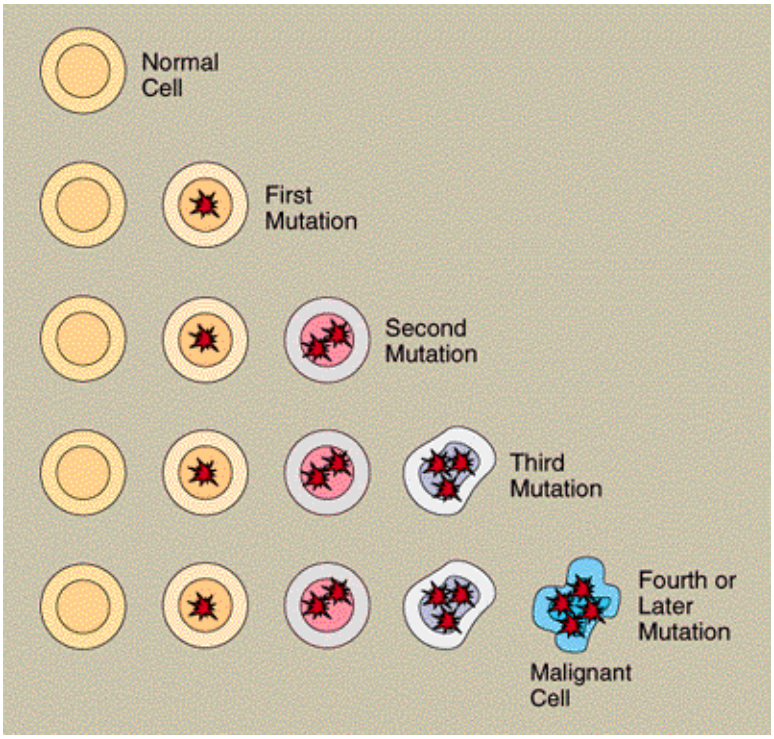
Onco- : means "tumor or mass"

-ology: means "the study of something"

Therefore oncology is the study of tumors or cancer!

CANCER IS A MULTI-STEP PROCESS

The process by which a normal cell is turned into a malignant cell involves many changes. No single event is enough to turn a normal cell into a cancer cell. Instead, it is thought to be that it takes "multiple hits" over time to cause cancer. These multiple hits are usually the accumulation of damage of many different genes that normally control cell growth. This is why the incidence of cancer often increases with age. Over time, a person's body can accumulate more and more genetic damage or mutations.



WHO GETS CANCER? HOW DOES IT AFFECT YOU AND ME?

Over one million people get cancer each year. Approximately one out of every two American men and one out of every three American women will have some type o f cancer at some point during their lifetime. Anyone can get cancer at any age; however, about 77% of all cancers are diagnosed in people age of 55 and older. Although cancer occurs in Americans of all racial and ethnic groups, the rate of cancer occurrence (called the incidence rate) varies from group to group. Today, millions of people are living with cancer or have been cured of the disease. The sooner a cancer is found and the sooner treatment begins, the better a patient's chances are of a cure. That's why early detection of cancer is such an important weapon in the fight against cancer.

EPIDEMIOLOGY OF CANCER

Cancer is the second leading cause of death in the United States. Nearly half of all men and a little over one third of all women in the United States will develop cancer during their lifetimes. Today, millions of people are living with cancer or have had cancer. The risk of developing most types of cancer can be reduced by changes in a person's lifestyle, for example, by quitting smoking and eating a better diet. The sooner a cancer is found and treatment begins, the better are the chances for living for many years.

Cancer Incidence: The number of newly diagnosed cases for a specific cancer or for all cancers combined during a specific time period.

Cancer Prevalence: The number of current cases for a specific cancer or for all cancers combined during a specific time period.

WHAT ARE THE RISK FACTORS FOR CANCER?

What is a risk factor? A risk factor is anything that increases a person's chance of getting a disease. Some risk factors can be changed, and others cannot. Risk factors for cancer can include a person's age, sex, and family medical history. Others are linked to cancer-causing factors in the environment. Still others are related to lifestyle choices such as tobacco and alcohol use, diet, and sun exposure.

Having a risk factor for cancer means that a person is more likely to develop the disease at some point in their lives. However, having one or more risk factors does not necessarily mean that a person will get cancer. Some people with one or more risk factors never develop the disease, while other people who do develop cancer have no apparent risk factors. Even when a person who has a risk factor is diagnosed with cancer, there is no way to prove that the risk factor actually caused the cancer.

Types of Cancer and associated risk factors:

Different kinds of cancer have different risk factors. Some of the major risk factors include the following:

- Cancers of the lung, mouth, larynx, bladder, kidney, cervix esophagus, and pancreas are related to tobacco use, including cigarettes, cigars, chewing tobacco, and snuff. Smoking alone causes one-third of all cancer deaths.
- Skin cancer is related to unprotected exposure to strong sunlight.
- Breast cancer risk factors include several factors: age; changes in hormone levels throughout life, such as age at first menstruation, number of pregnancies, and age at menopause; obesity; and physical activity. Also, women with a mother or sister who have had breast cancer are more likely to develop the disease themselves.
- While all men are at risk for prostate cancer, several factors can increase the chances of developing the disease, such as age, race, and diet. The chance of getting prostate cancer goes up with age. Prostate cancer is more common among African-American men than among white men. (We do not yet know why this is so.) A high-fat diet may play a part in causing prostate cancer. Also, men with a father or brother who have had prostate cancer are more likely to get prostate cancer themselves.

TYPES OF CANCER: How are different cancers named?

Cancer is a general term for more than 100 diseases characterized by the uncontrolled , abnormal growth of cells in different parts of the body. Certain types of cancer can often spread to from one location to another (metastasis). Cancer is classified into five major groups:

Carcinoma

Carcinoma is a cancerous tumor originating in the epithelial system (surface tissue of body organs). Carcinoma is the most common form of cancer accounting for nearly 80% to 90% of all cases.

Sarcoma

Sarcoma is a disease in which malignant tumors are found in the bone, cartilage, muscle, fibrous connective tissue, or fatty tissue. There are three main types of sarcomas including soft tissue, Kaposi's, and Ewing's. Soft tissue sarcomas develop in the muscles, fat, blood vessels, nerves, and synovial tissues (tissues around joints). Kaposi's sarcoma is found in the tissues under the skin or mucous membranes which line the mouth, nose, and anus. It causes red or purple lesions on the skin and spreads to other parts of the body. Ewing's sarcoma is a rare disease in which cancerous cells are found in the bone. It occurs most commonly in the pelvis, the thigh bone, the upper arm bone, or the ribs. Ewing's sarcoma is most often seen in teenagers.

Myeloma

Myeloma is the uncontrolled growth of plasma cells in the bone marrow. Plasma cells are a critical part of the body's immune system. They are manufactured in bone marrow and then move into the bloodstream.

Lymphoma

Lymphoma is a cancerous tumor originating in the lymph system. The lymph system is a connecting network of glands and vessels which produce and circulate lymph through the body. Lymph is a colorless, watery fluid that contains white blood cells called lymphocytes. Along the vessels are organs called nodes. Lymph nodes are found in the neck, under the arms, in the groin and abdomen. Lymph nodes make and store infection fighting cells. When lymphoma occurs, cells in the lymphatic system grow abnormally. They divide to rapidly and grow without order or control. The cells are immature and do not die like a normal cell. They continue to divide as immature cells that cannot do their jobs well. Too much tissue is formed and tumors begin to grow. Because there is lymph tissue in many parts of the body, the cancer cells may spread to other parts of the body such as the liver or spleen or into the bone marrow. Lymphomas are divided into Hodgkin's and non-Hodgkin's lymphomas. They are distinguished by cell type and they share similar symptoms such as painless swelling of the lymph nodes, fever, and fatigue.

Leukemia

Leukemia is a malignant disorder of the body's blood forming tissue - mainly bone marrow, lymph nodes and spleen. In leukemia, the blood forming tissues flood the bloodstream and lymph system with immature white blood cells. The immature cells cannot fight infections. They reduce the production of normal red blood cells and tiny discs called platelets. Uncontrolled leukemia causes infections due to the lack of normal infection fighting white blood cells; severe anemia due to the lack of oxygen carrying red blood cells; and bruising and hemorrhaging, due to the lack of platelets. Leukemia is divided into two categories, acute and chronic. Acute affects leukemia immature white blood cells, progresses rapidly, and is most is often seen in children. Chronic leukemia occurs most frequently in adults and progresses slowly.

FACTS ABOUT DIFFERENT KINDS OF CANCER:

Breast Cancer Facts:

Breast cancer is a malignant tumor that has developed from cells of the breast. The disease occurs almost entirely in women, but men can get it, too.

1. The female breast is made up mainly of:

a. lobules (milk-producing glands)
b. ducts (milk passages that connect the lobules to the nipple)
c. stroma (fatty tissue and connective tissue surrounding the ducts and lobules, blood vessels, and lymphatic vessels)

2. Most breast cancers begin in the cells that line the ducts (ductal), some in the cells that line the lobules (lobular), and the rest in other tissues.

3. Benign Breast Lumps
   a. Most breast lumps are not cancerous, that is, they are benign. Still, many need to be biopsied to prove they are not cancer.
   b. Most lumps turn out to be fibrocystic changes. The term "fibrocystic" refers to fibrosis and cysts. Fibrosis is the formation of fibrous (or scar-like) tissue, and cysts are fluid-filled sacs.
   c. Fibrocystic changes can cause breast swelling and pain. This often happens just before a period is about to begin. Your breasts may feel nodular, or lumpy, and, sometimes, you may notice a clear or slightly cloudy nipple discharge.

4. Breast cancer is the most common cancer in women, except for nonmelanoma skin cancer

5. The chance of developing invasive breast cancer at some time in a woman's life is about 1 in 8 (13% of **women**)

6. It is estimated that in 2005 about 211,240 new cases of invasive breast cancer will be diagnosed among **women** in the United States.

7. An estimated 1,690 cases of invasive breast cancer will be diagnosed in **men** in 2005.

8. At this time there are slightly over 2 million breast cancer survivors in the United States.

9. Women living in North America have the highest rate of breast cancer in the world.

10. Breast cancer incidence rates have continued to increase since 1980, although the rate of increase slowed in the 1990s, compared to the 1980s.

11. Breast cancer is the second leading cause of cancer death in women, exceeded only by lung cancer.

12. The chance that breast cancer will be responsible for a woman's death is about 1 in 33 (3%).

13. Death rates from breast cancer have been declining. These decreases are believed to be the result of early detection and improved treatment.

14. Your risk of developing breast cancer increases as you get older. About 18% of breast cancer diagnoses are among women in their 40s, while about 77% of women with breast cancer are older than 50 when they are diagnosed.

15. Recent studies have shown that about 5% to 10% of breast cancer cases are hereditary as a result of gene changes (mutations). The most common gene changes are those of the BRCA1 and BRCA2 genes. Normally, these genes help to prevent cancer by making proteins that keep cells from growing abnormally. However, if you have inherited either mutated gene from a parent, you are at increased risk for breast cancer.

16. Women who have had no children or who had their first child after age 30 have a slightly higher breast cancer risk.

17. The goal of screening examinations for early breast cancer detection is to find cancers before they start to cause symptoms.

18. Women age 40 and older should have a screening mammogram every year and should continue to do so for as long as they are in good health.

19. The current five-year survival rate for women with breast cancer is 86%.

Lung Cancer Facts:

Your lungs are two sponge-like organs found in your chest cavity. Your right lung is divided into 3 sections, called lobes. Your left lung has 2 lobes. It is smaller because your heart takes up more room on that side of the body. When you breathe, air goes into your lung through the *trachea* (windpipe). The trachea divides into tubes called the *bronchi*, which divide into smaller branches called the *bronchioles*. At the end of the bronchioles are tiny air sacs known as *alveoli*. Many tiny blood vessels run through the alveoli, absorbing oxygen from the inhaled air into your bloodstream and releasing carbon dioxide. Taking in oxygen and getting rid of carbon dioxide are your lungs' main function. A slippery lining, called the pleura, surrounds the lungs. This lining protects your lungs and helps them slide back and forth as they expand and contract during breathing.

1. Most lung cancers start in the lining of the bronchi. That is why another term for lung cancer is *bronchogenic cancer.*

2. There are two major types of lung cancer:

- small cell lung cancer (SCLC)
- non-small cell lung cancer (NSCLC).

3. Small Cell Lung Cancer

About 13% of all lung cancers are the small cell type (SCLC), named for the small round cells that make up these cancers. SCLC tends to spread widely through the body. This is important because it means that treatment must include drugs to kill the widespread disease. The cancer cells can multiply quickly, form large tumors, and spread to lymph nodes and other organs such as the bones, brain, adrenal glands, and liver. This type of cancer often starts in the bronchi near the center of the chest. Small cell lung cancer is almost always caused by smoking. It is very rare for someone who has never smoked to have small cell lung cancer. Other names for SCLC are oat cell carcinoma and small cell undifferentiated carcinoma.

4. Non-small Cell Lung Cancer

The remaining 87% of lung cancers are non-small cell (NSCLC). There are three sub-types of NSCLC. The cells in these sub-types differ in size, shape, and chemical make-up.

- **squamous cell carcinoma:** About 25% - 30% of all lung cancers are squamous cell carcinomas. They are associated with a history of smoking and tend to be found centrally, near a bronchus.

- **adenocarcinoma:** This type accounts for about 40% of lung cancers. It is usually found in the outer region of lung. People with one type of adenocarcinoma, known as bronchioloalveolar carcinoma (sometimes called bronchoalveolar carcinoma or bronchioalveolar carcinoma) tend to have a better outlook (prognosis) than those with other types of lung cancer.

- **large-cell undifferentiated carcinoma:** This type of cancer accounts for about 10% - 15% of lung cancers. It may appear in any part of the lung, and it tends to grow and spread quickly resulting in a poor prognosis.

5. During 2005, there will be about 172,570 new cases of lung cancer. Lung cancer will account for about 13% of all new cancers.

6. Lung cancer mainly occurs in the elderly. The average age of people diagnosed with lung cancer is 70; fewer than 3% of all cases are found in people under the age of 45.

7. The chance that a man will develop lung cancer is 1 in 13 and for a woman, it is 1 in 18. Of course this figure includes all people and doesn't take into account whether or not they smoke.

8. Lung cancer is the leading cause of cancer death among both men and women. There will be an estimated 163,510 deaths from lung cancer (90,490 among men and 73,020 among women) in 2005, accounting for around 28% of all cancer deaths. More people die of lung cancer than of colon, breast, and prostate cancers combined. In spite of the large number of people diagnosed with this cancer, there are only about 330,000 long-term survivors.

9. Nearly 60% of people diagnosed with lung cancer die within one year of their diagnosis. Nearly 75% die within 2 years. This had not improved in 10 years.

10. The 5-year relative survival rate for all stages of lung cancer combined is only 15%. This has improved slightly in the last few years.

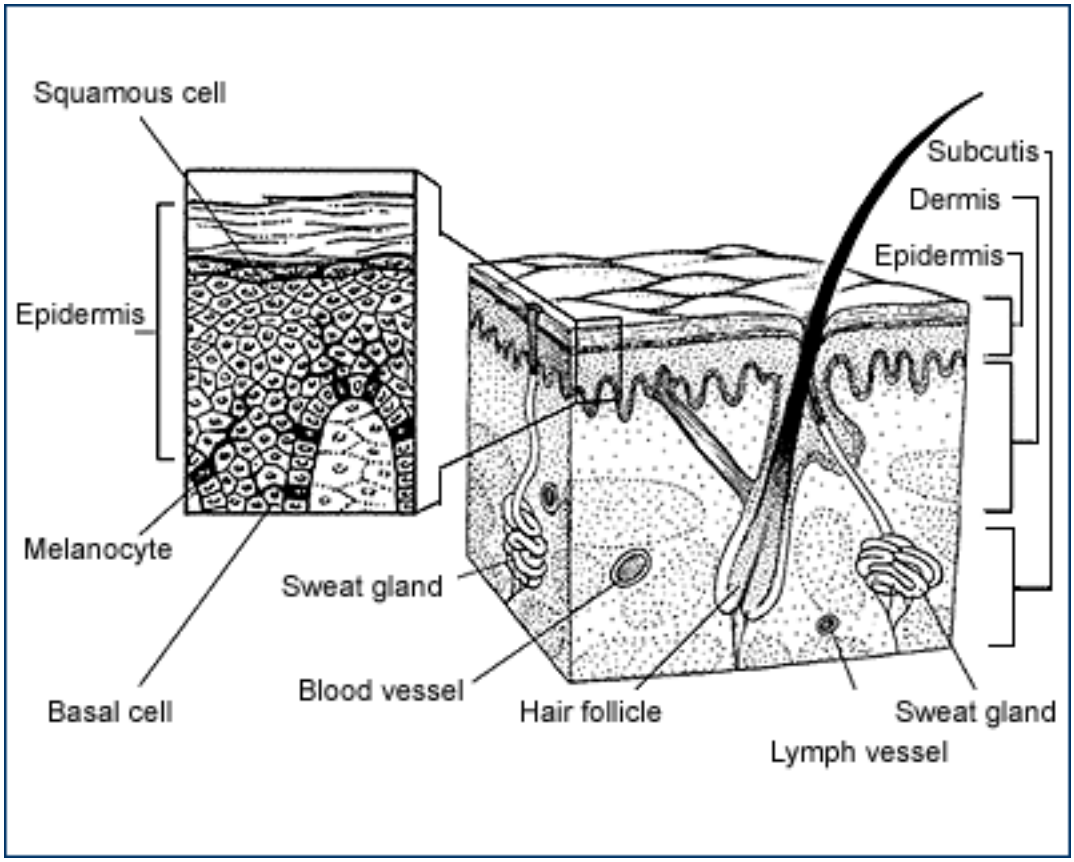
11. About 87% of lung cancers are thought to result from smoking or passive exposure to tobacco smoke. The longer you smoke and the more packs per day you smoke, the greater your risk.

12. If you don't smoke, but breathe in the smoke of others (called secondhand smoke or environmental tobacco smoke) you are also at increased risk for lung cancer. A nonsmoker who is married to a smoker has a 30% greater risk of developing lung cancer than the spouse of a nonsmoker.

Melanoma Facts:

The skin is the largest organ in your body. It covers the internal organs and protects them from injury, serves as a barrier between germs such as bacteria and internal organs, and prevents the loss of too much water and other fluids. The skin controls body temperature and helps rid your body of excess water and salts. Certain cells in your skin communicate with your brain and allow you to feel sensations of temperature, touch, and pain.

The skin has 3 layers called the *epidermis, dermis,* and *subcutis.* The top layer is the epidermis. The two main types of skin cancer, *melanoma* and *non-melanoma* begin in the epidermis. The epidermis is very thin, averaging only 0.2 mm (about 1/100 of an inch). It protects the deeper layers of skin and the organs of the body from the environment.



The outermost part of the epidermis is called the stratum corneum, or horny layer. It is composed of *keratinocytes* (also called *squamous cells*) that are no longer living. Keratinocytes are the main cell type of the epidermis.

Melanocytes, the cell that can become *melanoma,* are also present in the epidermis. These skin cells produce the protective brown pigment called *melanin,* which makes skin tan or brown. Melanin is formed to protect the deeper layers of the skin from

the harmful effects of the sun. The epidermis is separated from the deeper layers of skin by the basement membrane. The basement membrane is an important structure because when a cancer becomes more advanced, it generally grows through this barrier,

1. Melanoma is a cancer that begins in the melanocytes.

2. Because most melanoma cells still produce melanin, melanoma tumors are usually brown or black.

3. Melanomas can occur anywhere on the skin, but are more likely to develop in certain locations. The trunk is the most common site in men. In women, the legs are most commonly affected.

4. Having darkly pigmented skin lowers your risk, but it is not a guarantee that you will not develop melanoma.

5. Anyone, including people with dark skin, can develop this cancer on the palms of the hands, soles of the feet, and under the nails. Melanomas of the palms, soles, and nails represent about half of all melanomas in African Americans but fewer than 10% of melanomas in whites.

6. A kind of skin tumor that looks like melanoma is called a Spitz nevus. These tumors can be confused with melanoma. They are generally benign and don't spread, but sometimes doctors have difficulty telling Spitz nevi from true melanomas. They are treated the same as very early stage melanomas with simple excision.

7. Cancer of the skin is the most common of all cancers, probably accounting for more than 50% of all cancers. Melanoma accounts for about 4% of skin cancer cases but causes a large majority of skin cancer deaths.

8. Melanoma tends to occur at a younger age than most cancers. Half of all melanomas are found in people under age 57.

9. The American Cancer Society estimates that about 59,580 new melanomas will be diagnosed in the United States during 2005.

10. The number of new melanomas diagnosed in the United States is increasing.

11. About 7,770 people in the United States are expected to die of melanomas during 2005.

12. A nevus (the medical name for a mole) is a benign (noncancerous) melanocytic tumor.

13. The risk of melanoma is about 20 times higher for whites than for African Americans. This is because skin pigment has a protective effect. Whites with red or blond hair or fair skin that freckles or burns easily are at increased risk.

14. The simplest and most effective way to limit exposure to UV light is to avoid being outdoors in sunlight too long. This is particularly important in the middle of the day between the hours of 10 am and 4 pm, when UV light is strongest.

Colon Cancer Facts:

Colorectal cancer is a term used to refer to cancer that develops in the colon or the rectum. The colon and rectum are parts of the digestive system, which is also called the gastrointestinal, or GI, system. The digestive system processes food for energy and rids the body of solid waste matter (fecal matter or stool).

After food is chewed and swallowed, it travels through the esophagus to the stomach. There it is partly broken down and then sent to the *small intestine*, also known as the *small bowel*. The word "small" refers to the diameter of the small intestine, which is narrower than that of the large bowel. Actually the small intestine is the longest segment of the digestive system -- about 20 feet. The small intestine continues breaking down the food and absorbs most of the nutrients. The small bowel joins the colon in the right lower abdomen. The *colon* (also called the *large bowel* or *large intestine*) is a muscular tube about 5 feet long. The colon continues to absorb water and mineral nutrients from the food matter and serves as a storage place for waste matter. The waste matter left after this process is feces and goes into the *rectum*, the final 6 inches of the digestive system. From there it passes out of the body through the *anus*.

1. The wall of each of the four different sections of the colon and rectum has several layers of tissue. Colorectal cancer starts in the innermost layer and can grow through some or all of the other layers.

2. Colon cancer and rectal cancer, collectively known as colorectal cancer, have many features in common.

3. In most people, colorectal cancers develop slowly over a period of several years. Before a true cancer develops, a growth of tissue or tumor usually begins as a non-cancerous polyp, which may eventually change into cancer. A polyp develops on the lining of the colon or rectum. Certain kinds of polyps, called *adenomatous polyps* or *adenomas*, have the potential to become cancerous.

4. More than 95% of colorectal cancers are *adenocarcinomas*. These are cancers of the glandular cells that line the inside layer of the wall of the colon and rectum.

5. Excluding skin cancers, colorectal cancer is the third most common cancer diagnosed in men and in women in the United States. The American Cancer Society estimates that about 104,950 new cases of colon cancer (48,290 men and 56,660 women) and 40,340 new cases of rectal cancer (25,530 men and 16,810 women) will

be diagnosed in 2005.

6. Colorectal cancer is the second leading cause of cancer-related deaths in the United States and is expected to cause about 56,290 deaths (28,540 men and 27,750 women) during 2005.

7. The death rate from colorectal cancer has been dropping for the past 15 years. There are a number of likely reasons for this. One reason is probably because polyps are being found by screening before they can develop into cancers. Also, colorectal cancer is being found earlier when it is easier to cure, and treatments have improved. Because of this, there are around 1 million survivors of colorectal cancer in the United States.

8. The 5-year relative survival rate for people whose colorectal cancer is treated in an early stage, before it has spread, is greater than 90%. But only 39% of colorectal cancers are found at that early stage. Once the cancer has spread to nearby organs or lymph nodes, the 5-year relative survival rate goes down.

9. Familial adenomatous polyposis is a disease where people typically develop hundreds of polyps in their colon and rectum. Usually this occurs between the ages of 5 and 40. Cancer usually develops in 1 or more of these polyps beginning at age 20. By age 40 almost all people with this disorder will have developed cancer if preventive surgery is not done.

10. Hereditary nonpolyposis colon cancer (HNPCC) is the other clearly defined genetic syndrome. It accounts for 3% to 4% of all colorectal cancers. This also develops when people are relatively young. These people also have polyps, but they only have a few, not hundreds.

11. Jews of Eastern European descent (Ashkenazi Jews) have a higher rate of colorectal cancer.

12. People with diabetes have a 30% to 40% increased chance of developing colorectal cancer. They also tend to have a higher death rate after diagnosis.

13. One of the most powerful weapons in preventing colorectal cancer is regular colorectal cancer screening or testing. This is because polyps, or growths, can be detected and removed before they have the chance to turn into cancer. Screening can also result in finding colorectal cancer early, when it is highly curable.

Pancreatic Cancer Facts:

The pancreas is a gland located behind the stomach. It is shaped a little bit like a fish with a wide head, a tapering body, and a narrow-pointed tail. It is about 6 inches long but less than 2 inches wide and extends horizontally across the abdomen. The head of the pancreas is located on the right side of the abdomen, behind the place where the stomach meets the duodenum (the first part of the small intestine). The body of the pancreas is located behind the stomach and the tail of the pancreas is on the left side of the abdomen next to the spleen.

The pancreas contains 2 separate glands: the *exocrine* and *endocrine* glands. The exocrine gland produces pancreatic "juice," which contains enzymes that help you digest fats, proteins, and carbohydrates in the food you eat. Without these, some of the food you eat would just pass through your intestinal tract – sometimes leading to diarrhea. The enzymes are released into tiny tubes called *ducts*. These ducts carry the pancreatic juice to the small intestine. More than 95% of the cells in the pancreas are exocrine glands and ducts.

A small percentage of the cells in the pancreas are endocrine cells. These cells are arranged in small clusters called islets (or islets of Langerhans). The islets release 2 hormones, insulin and glucagon. Insulin is important in reducing the amount of sugar in the blood while glucagon increases it.

1. The exocrine cells and endocrine cells of the pancreas form completely different types of tumors.

2. Benign cysts of the pancreas can occur, as can benign tumors of the exocrine cells called *cystadenomas*. Most tumors, however, are malignant. About 95% of cancers of the exocrine pancreas are adenocarcinomas.

3. Tumors of the endocrine pancreas are much less common. As a group, they are known as neuroendocrine tumors, or more specifically, islet cell tumors.

4. Over the past 15 to 25 years, rates of cancer of the pancreas have slowly dropped in men and women.

5. The American Cancer Society estimates that 32,180 Americans (16,100 men and 16,080 women) will be diagnosed with cancer of the pancreas during 2005.

6. An estimated 31,800 Americans (15,820 men and 15,980 women) will die of pancreatic cancer in 2005, making this type of cancer the fourth leading cause of cancer death overall.

7. Only about 23% of patients with cancer of the exocrine pancreas will be alive 1 year after their diagnosis; only about 4% will live 5 years after diagnosis. Even for those people diagnosed with local disease (has not spread to other organs), the 5-year *relative survival* rate is only 15%.

8. There are no established guidelines for preventing cancer of the pancreas. For now, the best approach is to avoid pancreatic cancer risk factors whenever possible.

9. Cigarette smoking is the most significant and avoidable risk factor for cancer of the pancreas. It is responsible for 30% of pancreatic cancers.